



# HEATRODES SYSTEM SPEEDS UP REMEDiation AT CONTAMINATED SITES

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## Payoff

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The new *in situ* soil heating and bioventing system could accelerate the clean up and restoration of contaminated sites within the Department of Defense (DoD) as well as the commercial industry. The system is also effective in restoring sites contaminated by complex substances such as polyaromatic hydrocarbons, polychlorinated biphenyls, chlorinated compounds and metals.

## Accomplishment

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A Small Business Innovation Research (SBIR) funded research effort, supported by the Materials and Manufacturing Directorate (ML) and Donald J. Geisel & Associates, Inc., Clifton Park, NY, successfully designed, developed and demonstrated an efficient, cost-effective soil heating and bioventing system capable of cleaning up complex contamination spills and leaks. The new system uses a network of embedded, closed-loop devices called “HeatTrodes” to accelerate the bioremediation process *in situ* by warming the surrounding soil and supplying oxygen to help aerate the site. Continuing application of this system throughout the DoD and private industry could save millions of dollars annually by reducing the need to excavate and haul or incinerate contaminated soil.

## Background

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Bioremediation and soil vapor extraction (SVE) are two of the more cost-effective approaches for *in situ* remediation of sites with soil and groundwater contamination. Both have proven track records, however, SVE is applicable for only the lighter or easily volatilized compounds. With its remedial value dependent on bioavailability, target bacterium, nutrients, oxygen and temperature, bioremediation is effective for only just certain classes of contaminants. Consequently, in cases involving more complex contaminants such as polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), several chlorinated compounds, and heavy metals, soil excavation and hauling or incineration is often the likely solution, despite the time and expense. Research from past studies in soil remediation identified the potential advantages of speeding up clean up processes and increasing their effectiveness using thermal enhancement. These studies found that warming the soil enhances the volatilization process in SVE operations and also improves bioactivity rates and bioavailability in bioremediation processes. Working with scientists and engineers at ML's Airbase and Environmental Technology Division at Tyndall AFB, FL, Geisel & Associates carefully tested an innovative, direct warming approach to cleaning up JP-4 contaminated soil at Stratton Air National Guard Base in Scotia, NY. Field studies, conducted over a two and one-half year period, tracked closely with the data from a parallel biological study conducted in the laboratory at the University of Buffalo using soil from the Stratton site. These tests, administered under Phase II of the SBIR program, demonstrated that the new thermal enhancement approach, combined with a bioventing system to stimulate biological activity and promote bioremediation by aerating the subsurface, was highly effective under both field and laboratory conditions.